

LAPIDUS, L.I.

SUBJECT USSR / PHYSICS
 AUTHOR LAPIDUS, L.I.
 TITLE On the Determination of the Spins of K-Particles and Hyperons.
 PERIODICAL Zhurn.eksp.i teor.fis, 31, fasc.2, 342-343 (1956)
 Issued: 10 / 1956 reviewed: 10 / 1956

CARD 1 / 2

PA - 1447

For the "strange" particles there are no reactions that develop with great probability and are similar to the reaction $p + p \rightarrow d + \pi$. With this reaction it would be possible to determine the spin of the unknown particle. In the case of the reaction $K^- + d \rightarrow \Sigma^- + p$ (1) which is analogous to the reaction $\pi^- + d \rightarrow n + n$, slow particles are not forbidden as was the case with pions, for Σ^- and p are not homogeneous particles. According to T.D.LEE, Phys.Rev. 99, 337 (1955) the latter reaction (1) is suited for the determination of the spin of the new particles. For this purpose it is possible to use analogous reactions with other nuclei instead of (1): $K^- + H^3 \rightarrow \Sigma^- + d$, $K^- + He^4 \rightarrow \Sigma^- + He^3$ (2), $K^- + He^4 \rightarrow \Lambda^0 + H^3$ (3) etc. The experimental data concerning the interaction of slow particles apparently indicate that of the two capturing processes: $K^- + N \rightarrow \Lambda^0 + \pi$, $K^- + N \rightarrow \Sigma + \pi$ (4) the first is more probable by one order than the second. Therefore it is useful to study the reaction of the type (3), and besides also other possibilities for the determination of data concerning the spins of the new particles remain to be investigated. A further possibility for the study of the spins of hyperons and K-mesons is based on the fact that the bundles of particles produced on the occasion of

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nuclear interactions are partly polarized. As is known, the scattering cross section of a polarized bundle depends on the angle θ and on the azimuth φ . However, if the dependence of θ depends on the part played by transitions, the character of the dependence of φ is determined by the spin of the particle. Thus, a dependence that is proportional to $\cos \varphi$ is characteristic of particles with spin $1/2$, for particles with spin 1 : $\cos \varphi + A \cos 2\varphi$, for particles with spin $3/2$: $\cos \varphi + a \cos 2\varphi + b \cos 3\varphi$, and for particles with any spin the dependence $\sum_{n=1}^{2s} A_n \cos n\varphi$ applies. Here s denotes the spin of the particle. The

existence of such a dependence is based on the fact that the orbital momentum has no projection ($m = 0$) so that the values of the projection of the total moment of the momentum are identical with the possible values of the projections of the spin of the particles.

The fact that the particles belong to the bosons or fermions can, for example, be determined from the decay scheme. Consequently it is necessary, if e.g. it is known that the K-particle is a boson, to separate the following experimentally: The lack of the dependence of φ at $s = 0$ on the existence of a dependence of the type $\cos \varphi + A \cos 2\varphi$ at $s = 1$.

INSTITUTION: Institute for Nuclear Problems of the Academy of Science in the USSR.

LAPIDUS, L.I.

SUBJECT. USSR / PHYSICS

CARD 1 / 2

PA - 1449

AUTHOR GALANIN, A.D., LAPIDUS, L.I.

TITLE Remarks on the Mixed Meson Theory.

PERIODICAL Zhurn. eksp. i teor. fis., 31, fasc. 2, 359-359 (1956)

Issued: 10 / 1956 reviewed: 10 / 1956

R.P. FEYNMAN, Phys. Rev., 76, 769 (1949) declared that in the mixed theory of scalar and vectorial mesons with vectorial coupling the nonrenormalizable infinities are removed if the coupling constants are equal. The work by D.B. BEARS and H.A. BETHE, Phys. Rev., 83, 1106 (1951) deals with the employment of this theory for the study of nuclear forces. The same is said in the book by S.S. SCHWOBER, H.A. BETHE and F. de HOFFMANN, Mesons and Fields, vol. 1, New York (1955). Actually, however, the removal of nonrenormalizable infinities in this case is equivalent to the fact that the equation for the vectorial meson

$(p^2 \delta_{\nu\mu} - p_\nu p_\mu) \varphi_\mu = -s_\nu$ is transformed into $p^2 \varphi_\nu = -s_\nu$. In this case the field φ_ν describes the particles with spin 1 and zero, on which occasion a negative energy corresponds to the components with spin zero. (See G. WENTZAL, Einführung in die Quantentheorie der Wellenfelder). If, however, we proceed from the Hermitic LAGRANGIAN of two fields with spin zero and 1 which are in interaction with a nucleon field, we find that nonrenormalizable divergences are not removed but that they are superimposed. For each line of a vectorial meson (including the summit) the following is written down:

$$f_1^2 (\gamma_\nu \dots \gamma_\mu) (\delta_{\mu\nu} - k_\nu k_\mu / \mu_1^2) / (k^2 - \mu_1^2).$$

Here the series of points denotes

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any part of the diagram and for each line of the scalar meson the following is written down:

$$-(f_2^2/\mu_2^2)(\vec{k} \dots \vec{k}) (k^2 - \mu_2^2)^{-1}.$$

The minus sign in the last expression is due to the fact that one of the factors \vec{k} describes the production of a meson and the other an absorption. This sign follows also from FEYNMAN'S rule: k is equal to the difference between the initial- and end momenta of a nucleon.

From the two latter formulae it follows that the divergences connected with the factors \vec{k} in the numerator are cancelled only if it is true that

$$f_1^2/\mu_1^2 = - f_2^2/\mu_2^2, \text{ i.e. if one of the charges is imaginary.}$$

INSTITUTION:

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PA - 1874

SUBJECT

USSR / PHYSICS

AUTHOR

LAPIDUS, L.I.

TITLE

The Isotopic Invariance and the Production of Particles.

PERIODICAL

Zhurn. eksp. i teor. fis., 31, fasc. 5, 865-875 (1956)

Issued: 1 / 1957

The production processes of mesons are best suited for the direct experimental examination of the conclusions drawn from the law of conservation of isotopic spin. Thus there follows for pions, apart from the relation:
 $d\sigma(p + p \rightarrow \pi^+ + d) = 2d\sigma(n + p \rightarrow \pi^0 + d)$, only from isotopic invariance, also the relation $d\sigma(p + d \rightarrow H^3 + \pi^+) = 2d\sigma(p + d \rightarrow He^3 + \pi^0)$. Several further forbidding rules resulting from isotopic invariance are mentioned. From the conservation of isotopic spin it is possible to learn also something about the interaction between a meson and a nucleon or between a nucleon and a nucleon in states with a certain value of the isotopic spin of the system. The differential and total cross sections of elastic interaction in the states with $T = 3/2$ and $T = 1/2$ are given. Further, the cross sections of a whole series of processes are mentioned. Among other things, the photoproduction of individual deuterons on a deuteron are investigated in order to find out what relations occur between the cross sections in consideration of interaction between a meson and a nucleon in the state with determined $T_{\pi N}$. For the various processes of photoproduction also the matrix elements are mentioned. The author, among other things, is of the opinion that the "isobaric" model has by no means been experimentally confirmed. Only indi-

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cations of a considerably more important part played by the states with $T_{\pi N} = 3/2$ as "doublet states" in $\pi - N$ interaction have been obtained, and this is true for all production processes of real mesons.

There follow investigations of the consequences of isotopic invariance for the production processes of individual mesons in the case of interaction between nucleons and nuclei with the difference 1 and 2 between the number of neutrons and protons. The relations obtained on this occasion are suited for the verification of the hypothesis of isotopic invariance itself, for the determination of the purity of isotopic states, and also for the obtaining of data concerning processes which are difficult to examine. Also the production of mesons on the occasion of the interaction between nucleons and "mirror-image-like" nuclei like H^3 and He^3 , Li^7 and Be^7

is investigated. There follow data concerning the characteristic features of the relations between the cross sections and the production of mesons by nuclei in the case of a predominance of interaction in a state with determined $T_{\pi N}$. The most simple example herefore is the deuteron nucleus. In the

case of certain assumptions concerning the isotopic spin of K particles and hyperons it is possible to understand many of the peculiarities of the interaction of "strange" particles. In connection with BeV accelerators also a study of the production- and interaction processes of antinucleons is of interest.

INSTITUTION: Institute for Nuclear Problems of the Academy of Science in the USSR

AOR:
TITLE:
PERIODICAL:

LAPIDUS, L.I.

PA - 2027

The Optic Theorem and the Elastic Scattering into Small Angles.

Zhurnal Eksperimental'noi i Teoret.Fiziki, 1956, Vol 31, Nr 6

pp 1099-1101 (U.S.S.R.)

Received: 1 / 1957

Reviewed: 3 / 1957

ABSTRACT:

The total cross section of interaction is known to be proportional to the imaginary part of the amplitude of elastic scattering in the forward direction. The relation, which is sometimes called "optic theorem", is a consequence of the unitarity of the S-matrix and applies in the case of particles with any spin; it can be represented as follows: $\sigma_t = (4\pi/k) \text{Im Tr} M(0^\circ) / (2s_1 + 1) / (2s_2 + 1) (?)$.

Here the matrix $M(\theta)$ connects the wave scattered into the angle θ with the inciding wave and s_1, s_2 denote the spins of the col-

liding particles. $M(\theta)$ is then explicitly given for the following cases: Collision of a spinless particle with a particle with spin $1/2$; $s_1 = 1$ and $s_2 = 0$; scattering of a particle with spin

$s_1 = 1/2$ by a target with any spin s_2 ; $s_1 = 1$ and $s_2 = \text{arbitrary}$.

The differential cross sections of elastic scattering are expressed as follows by means of $M(\theta)$:

$\sigma(\theta) = \text{Tr} M^+(\theta) M(\theta) / (2s_1 + 1) (2s_2 + 1)$. Herefrom there follows

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in the case of any spin s_2 the formula $\sigma(\theta) = \text{Tr}(AA^* + HH^*)/2(2s_2 + 1)$. This formula applies in the case of $s_1 = 1/2$ and a similar formula applies also in the case of $s_1 = 1$. With the aid of the expressions given here it may be seen that for collisions of particles with any spin the simple inequation

$\sigma(0^\circ) \gg k^2 \sigma_t^2 / 16 \pi^2$ is valid. At $s_2 = 0$, $s_1 = 1$ the expressions for the total cross section and $\sigma(0^\circ)$ (where $Y(0^\circ) = Z(0^\circ) = 0$ is true) can be represented as follows:

$$k\sigma_t = 4\pi \text{Im}[X(0^\circ) + (2/3)W(0^\circ)] ; \sigma(0^\circ) = |X(0^\circ) + (2/3)W(0^\circ)|^2 +$$

$+(2/9)|W(0^\circ)|^2$. In the special case of $(\pi-N)$ -scattering it is possible, if $\sigma_t(E)$ is known with a wide range of energy, to compute the cross section of elastic scattering in a forward direction with the help of a dispersion relation. In the other cases, e.g. already in the case of $(n-\alpha)$ -scattering, it has hitherto been possible to compute only the lowest limit for the amount of this cross section. The aforementioned inequation offers a useful

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restriction which can be used when dealing with experimental data. As is shown by numerical estimations, the lowest limit of the amount of elastic scattering in the forward direction is rather high in some cases. Several examples are mentioned. Within the energy range of from 400 to 600 MeV an increase of the cross section within the range of small angles with a further tendency towards an increase in the case of an increase of the energy of the colliding particles becomes noticeable. A further example for the use of the restriction of the optic theorem is the scattering of mesons by nuclei.

ASSOCIATION: United Institute for Nuclear Research.
PRESENTED BY:
SUBMITTED:
AVAILABLE: Library of Congress.

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Distr: 4E3d

✓ Time reversal and polarization phenomena in $n + n \rightarrow d + \pi$ reactions. L. I. Lapidus (Joint Inst. Nuclear Research, Dubna, U.S.S.R.). *Nuclear Phys.* 4, 145-58 (1967) (in English).—Math. An analysis of polarization phenomena in $n + n \rightarrow d + \pi$ reactions reveals how time-reversal invariance leads to connections between polarization phenomena in direct and inverse reactions. The Wolfenstein theorem (W. and Ashkin, *C.A.* 46, 5981h) has been extended to the case of a binary reaction. Expressions are given for various observable quantities in $n + n \rightarrow d + \pi$ reactions for the case when only s , p , and d waves with $J \leq 2$ are considered as well as for the general case. G-2: P- 1/1

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LAPIDUS, I. I.

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A NOTE ON MIXED MESON THEORY. A. D. Golenin and
I. I. Lapidus. Soviet Phys. JETP 4, 290-1(1957) March.

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THE OPTICAL THEOREM AND ELASTIC SCATTERING
THROUGH SMALL ANGLES L. I. Lapidus (United Inst.
of Nuclear Research). Soviet Phys. JETP 4, 837-9(1957)
July.

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LAPIDUS, L.I.

26-11-5/16

AUTHORS: Lapidus, L.I., and Okonov, E.O.

TITLE: The Latest Research in the Physics of Fundamental Particles (Noveyskiye issledovaniya fiziki fundamental'nykh chastits)

PERIODICAL: Priroda, 1957, # 11, p 33-42 (USSR)

ABSTRACT: In 1956 the USSR opened the Joint Institute of Nuclear Research, placing it at the disposal of scientists from all Communist dominated countries. The Institute is furnished with the most modern equipment. It has a synchrocyclotron producing protons with an energy of up to 680 mev and, since April 1957, a synchrophasotron (Fig. 1), which can accelerate protons up to 10 BeV. With the synchrocyclotron the first experiments of scattering neutrons by neutrons could be inquired into, and it will also prove very useful for the study of the interaction between π -meson and nucleons, while the powerful accelerator opens new possibilities for the investigation of antiparticles. To discover exhaustive facts about the laws of interaction between elementary particles, many more experiments are needed, and in this work the Joint Institute will play an important part. As to the methods of observing the reactions of high energy particles, the authors point out that photographing by means of very thick emulsion

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LAPIDUS, L.I.

56-6-21/56

AUTHOR
TITLE

LAPIDUS, L.I.

Contribution to the Theory of Exchange Collisions between Fast Nucleons and Deuterons.

PERIODICAL

(K teorii obmennyykh stolknoveniy bystrykh nuklonov s deytunami.- Russian)
Zhurnal Eksperim. i Teoret. Fiziki 1957, Vol 32, Nr 6, pp 1437-1441 (U.S.S.R.)

ABSTRACT

At first short reports on some previous works are given. The present paper shows that in the case of general assumptions as to the amount M of the amplitude of the nucleon-nucleon scattering for angles near 180° ($\theta = 0^\circ$) the data on the exchange scattering of nucleons with an energy of from 300 to 400 MeV can be used also for the determination of additional data on the scattering of neutrons by protons. This applies on the assumption that only low momenta are transferred.

At first expressions are given for the differential cross section of n-p scattering (after averaging on the spins in the initial stage and summation over the spins at the final stage) and for the differential cross section of the exchange collisions between neutrons and deuterons. The results of the exchange - n - d - scattering can be used for the determination of data on the spin dependence

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Contribution to the Theory of Exchange Collisions between Fast Nucleons and Deuterons.

of the amplitude of n-p scattering and for the phase analysis of the data on n-p scattering. The main result of the experiments can be represented in the form

$$[\operatorname{Re} N^* (G-N-B) - I H^2 - (1/4) | B + G - N^2] \theta_n = 180^\circ =$$

$$(1/5) d\sigma_{pr}(180^\circ)/d\omega.$$

The significance of the amounts contained in this expression is given. From the point of view of the phase analysis this expressing selects from all sets of scattering phases (which correspond to the experimental data on the unpolarized cross section of the n-p scattering and on the polarization on the occasion of n-p collisions) only those which correspond to the experimental data concerning the n-d-scattering.
(No Illustrations).

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Contribution to the Theory of Exchange Collisions between Fast Nucleons and Deuterons.

56-6-21/56

ASSOCIATION: United Institute for Nuclear Research.
(Ob'yedinenyy institut yadernykh issledovaniy.- Russian)
PRESENTED BY: -
SUBMITTED: 28.8.1956
AVAILABLE: Library of Congress.

CARD 3/3

LAPIDUS, L. I.

AUTHOR
TITLE

LAPIDUS, L. I.

56-7-30/66

Time Reversal and Polarization Phenomena in $N + N \rightarrow d + \pi$ Reactions
(Otrazheniye vremeni i polarizatsionnyye yavleniya v reaktsiakh $N+N \rightarrow d+\pi$.
Russian)

PERIODICAL

Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol 33, Nr 7, pp 204 - 212
(U.S.S.R.)

ABSTRACT

The present paper phenomenologically analyzes the polarization phenomena on the occasion of the reactions $p + p \rightarrow d + \pi^+$ (A), $\pi^+ + d \rightarrow p + p$ (B), $n + p \rightarrow d + \pi^0$ (C), $\pi^0 + d \rightarrow n + p$ (D). It is intended, on the basis of this example, to find out what consequence result from the symmetry of the S-matrix $S_{a's'l', a'l}^J = S_{a'l, a's'l'}^J$ for a more general case of binary reactions. (Nuclear reactions with two particles in the initial- and final state). The main result of this paper is the generalization of WOLFENSTEIN'S theorem for the reactions investigated here. Besides, general expressions are obtained for the various observable orders in the reactions (A) and (B), viz. by using the interaction amplitude. The individual chapters of this paper deal with the S-matrix, the cross sections of interaction of nonpolarized particles, the polarization phenomena on the occasion of direct and inverse reaction.

Card 1/2

BILENKIY, S. M., LAPIDUS, L. I., FUZIKOV, L. D. and RYNDIN, R. M.

LAPIDUS, L. I.

"Phenomenological Analysis of Reactions of the $a + a' \rightarrow b + b'$ Type."
Nuclear Physics, vol. 7, No. 6, p. 646-654, 1958, No. Holland Publ. Co.

Abstract: Conditions for the construction from experimental data of the matrix for reactions of the $a + a' \rightarrow b + b'$ type are considered on basis of general principles of quantum mechanics. The reaction matrix M is expanded in a complete set of irreducible tensor operators $T_J^M(b, a)$ and the number of complex scalar functions which determine it is computed for the case when invariance under space rotations and reflections is taken into account. Time reversal invariance of the interaction leads to relations which are taken into account. Time reversal invariance of the interaction leads to relations between polarization effects in the direct and inverse reactions. The number of experiments required for complete construction of the reaction matrix in the presence of several channels can be determined on basis of unitarity of the S matrix.

The general form of the azimuthal dependence of the angular distribution of the reaction products (for arbitrary spins) is derived in the appendix.

Joint Inst. of Nuclear Research, Lab. of Theoretical Physics, Dubna, USSR

AUTHOR: Lapidus, L. I.

56-2-24/51

TITLE: The Application of Dispersion Relations to the π -N-
-Scattering at Low Energies (Primeneniye dispersionnykh
sootnosheniy k π -N-rasseyaniyu pri malykh energiakh)

PERIODICAL: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958,
Vol 34, Nr 2, pp 453-462 (USSR)

ABSTRACT: The author investigates the consequences of these dispersion relations without passing over to equations of the Low (Lou) type. In computing the deductions the dependence of the phases on the energy in accordance to the conception of the theory of effective length is used. Taking into account the experimental data on the phases the expressions for the first and second phase, for a half-sum describing the scattering of neutral pions on nucleons as well as one for the scattering of negative mesons are deduced. The course of calculation is followed step by step. These quantities computed in the first chapter can also be computed directly from the dispersion integral and from the experimental data on the total cross sections. For this purpose the dispersion

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The Application of Dispersion Relations to the π -N-
-Scattering at Low Energies

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integral is divided into 3 parts. The expressions found this way as well as an expression for the deductions of the dispersion integral $F(\omega) = k^2 J_+(\omega)$ are mentioned in detail. Thus the coincidence of the experimentally determined phases with the dispersion relations can be proved in a more basic way. After the determination of F_+ the values of the deductions can be calculated immediately after differentiation. The expressions found for the dispersion integrals are suitable for the calculations within the range of energies of $\omega - \mu \ll \mu$. ω denotes the total energy of mesons in the laboratory system. The transition from the center of mass system to that of the laboratory is carried out approximately. The dispersion integral for the interaction of negative mesons with protons is given and discussed. The numerical values of the dispersion integral are $J_+(\mu) = 6,96/4\pi^2 = 0,176$, $J_-(\mu) = 4,99/4\pi^2 = 0,126$. For the deductions of the dispersion integral the values $2J'_+(\mu) = 0,08\lambda_c$, $2J'_-(\mu) = 0,04\lambda_c$ are found by numerical integration. Thus the analysis carried out here, which uses only the data on the scattering phases of small energies, proves the result of G. Puppi and

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The Application of Dispersion Relations to the π -N-
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56-2-24, '51

A. Stanghellini, Nuovo Cim., 1957, Vol. 5, p. 1303. For the π -p-scattering the conclusions from the dispersion relations do not coincide with the experiment, however. This disagreement is not so great at small energies as it is at great energies. The reasons for the lacking agreement are not clear as yet. The contribution of the mesic atom deserves special investigation. Additional experiments and an exact elaboration of the experimental results would be desirable. Of especially great value would be the investigation of the polarization of recoil nucleons and of the interference with the Coulomb scattering. There are 10 references, 4 of which are Slavic.

ASSOCIATION: United Institute for Nuclear Research (Ob'yedinennyy institut yadernykh issledovaniy)

SUBMITTED: August 3, 1957

AVAILABLE: Library of Congress
Card 3/3

1. Pions-Scattering-Theory 2. Mesons-Scattering-Theory

AUTHOR: Lapidus, L. I.

SOV/56-34-3-53/55

TITLE: The Problem of the Interaction Between Hyperons and Nucleons (K voprosu o vzaimodeystvii giperonov s nuklonami)

PERIODICAL: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958, Vol. 34, Nr 3, pp. 777-779 (USSR)

ABSTRACT: The fact that the parity in the decay of hyperons is not conserved can be made use of for the investigation of the interaction between hyperons and free nucleons as well as for the investigation of hypernuclei. The observation of the asymmetry between up and down orientation of the decay products with respect to the scattering plane can serve as direct method for the determination of the spin-orbit dependence of the Y-N-forces. The fact that hyperons are produced in the π -N- and K-N-interactions obviously speaks in favor of the existence of a (LS)-dependence of the forces. For a direct proof, however, the asymmetry between up and down orientation in the decay of the hyperons polarized in the elastic Y-N-scattering must be observed.

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The Problem of the Interaction Between Hyperons and Nucleons SOV/56-34-3-53/55

The investigation of the asymmetry between up and down-orientation with respect to the plane of the production of hypernuclei can be used for the investigation of the structure of the hypernuclei as well as for the direct determination of the spin of the hyper fragment. The author investigates some of the consequences of the unitarity and the symmetry of the S-matrix for the Y-N-interactions. When the energies of the Λ -particles are less than 150 MeV only an elastic scattering is possible in the Λ -N-collision. This situation was analysed in connection with the N-N-scattering. When the energy of the Λ^0 -particles is more than 150 MeV besides elastic scattering also the processes of the transformation of Λ -particles into hyperons become energetically possible. All processes of the unitary and symmetric S-matrix are given here. The taking into account of the symmetry and the unitarity of the S-matrix makes it possible to express the 6 independent elements of the S-matrix by the 3 scattering phases $\delta_1, \delta_2, \delta_3$ as well as by the 3 mixing parameters φ, Θ, Ψ .

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The Problem of the Interaction Between Hyperons and Nucleons SOV/56-34-3-53/55

In the taking into account of the isotopic invariance the amplitudes of the interaction of Σ -particles with nucleons can be expressed by the amplitudes R_3 and R_1 of the Σ -N-scattering in the states with $T = 3/2$ and $T = 1/2$. A taking into account of the isotopic invariance decreases the number of necessary parameters to 4. A relation between the cross sections and the parity of the polarizations of the Λ -particles and the nucleons results from the relation

$$s_{12} = \sqrt{2} s_{13}$$

By generalizing the theorems by Vol'fenshteyn it is, for instance, possible to bring into connection the azimuthal symmetry of the nucleons and Σ -hyperons (when the Λ particles are polarized) in the transformation $\Lambda \rightarrow \Sigma$ with the polarization of the same beams (when the Λ are not polarized).

There are 5 references, 3 of which are Soviet.

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AUTHOR: Lapidus, L. I. 56-34-4-22/60

TITLE: The Reversal of Time and the Polarization Phenomena in the Reactions With γ -Quanta (Obrashcheniye vremeni i polarizatsionnyye yavleniya v reaktsiyakh s γ -kvantami)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 34, Nr 4, pp. 922 - 930 (USSR)

ABSTRACT: This work examines the polarization phenomena in the photo-production of pions and in the Compton effect at nucleons. The invariance of the interaction in the reflection of the time leads to relations not only between unpolarized (i.e. averaged over the spins) but also between the polarization phenomena in the mutually inverse reactions. This work also generalizes the theorems by L. Wolfenstein (Reference 1) to reaction with γ -quanta. The condition of the unitarity of the S-matrix which comprises the elastic scattering of pions by nucleons $-p \rightarrow -p$, $On \rightarrow On$; $+n \rightarrow +n$. $Op \rightarrow Op$; the exchange scattering $-p \rightleftharpoons On$, $+n \rightleftharpoons Op$; the photoproduction and the radiation capture $+n \rightleftharpoons \gamma p$, $-p \rightleftharpoons \gamma n$, $On \rightleftharpoons \gamma n$, $Op \rightleftharpoons \gamma p$ as well as the Compton effect $\gamma p \rightarrow \gamma p$, $\gamma n \rightarrow \gamma n$, permits it in any state to introduce 3 real

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phases and 3 displacement parameters. This makes it possible to determine the number of the necessary experiments, which decreases in case of the consideration of isotopic invariance. The unitarity condition is considered in a supplement. First the amplitudes of the photoproduction of pions and of the radiation capture of a negative pion are determined step by step. The trial of an experimental investigation of the photoproduction by the investigation of the radiation capture of a negative pion by a proton might be successful. Although these experiments are very difficult one might obtain by them data on the photoproduction by monochromatic γ -quanta at a free neutron. The authors first discuss the photoproduction of the pions and the radiation capture. The amplitude of the photoproduction is represented in the form $M = a + b\vec{\sigma}$. The quantities a resp. b must be a pseudoscalar resp. a vector. The process of computation is pursued step by step. The author examines also the cross section of the photoproduction of a meson by polarized γ -quanta at an unpolarized target. The next paragraph deals with the Compton effect. Some conclusions: The general result of this

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The Reversal of Time and the Polarization Phenomena
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work is the extension of the conclusions of the invariance in case of variation of the sign of time to reactions with participation of γ -quanta. The result is of theoretical and also of practical interest, for the investigation, e.g. of the polarization of the nucleons in the photodesintegration of a deuteron gives the same informations, just as well as the radiation capture of a polarized nucleon. The study of the polarization of a γ -quantum in the radiation capture of a neutron by a proton is equivalent to the study of the cross section of the photodesintegration of a deuteron by polarized γ -quanta. For the relation by Wolfenstein it is essential if the spatial parity is kept up or not. There are 22 references, 8 of which are Soviet.

ASSOCIATION: Ob'yedinennyy institut yadernykh issledovaniy (United Institute of Nuclear Research)

Card 3/4
2

AUTHOR: Lapidus, L. I. SOV/56-34-5-14/61

TITLE: Polarization in High Energy Elastic Scattering (Polyarizatsiya v uprugom rasseyanii pri vysokikh energiakh)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 34, Nr 5, pp. 1148-1153 (USSR)

ABSTRACT: This paper discusses the problem of the polarization phenomena at high energies. The author finds the particularities of these polarization phenomena. According to the approximation used by the author in the expression for the scattering cross section (averaged over the spins) there are "diffraction terms". The author first investigates the elastic scattering of particles with spin $1/2$ on particles without spin (case, $(0, 1/2)$). The author deals with this problem in a manner that is different to that of some earlier papers. Without explicitly introducing the interaction potentials, the author determines the absorption coefficients K_1 and K_2 and the refraction indices n_1 and n_2 . Calculations are carried out for an infinite absorption and also for the case without refraction ("Gray absorbing nucleus"). The expressions for differential and for the total elastic scattering are explicitly given. The polarization phe-

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nomena are then taken into account. In the energy region in which scattering phases are purely imaginary, there is no azimuthal asymmetry. An expression is then given for the polarization P_{pu} after the scattering of the polarized beam. The polarization P_{uu} is connected with the fact that the refraction indices n_1 and n_2 are different from the value 1. The maximum value of polarization corresponds to the values $n_1=1$ and $K_2=0$. In this paper electromagnetic effects are not taken into account, but the taking into account of electromagnetic effects is essential in some cases and may be of eminent interest for the electromagnetic properties of the nucleons (relaxation of the magnetic moments). The qualitative results, without respect to P_{uu} found for the elastic scattering of particles with spin $1/2$ on a target without spin (case $(0, 1/2)$) hold also for the cases $(1/2, 1/2)$ (nucleon - nucleon scattering) and $(1,0)$ (scattering of deuterons on particles without spin). For imaginary phases of $N - N$ - scattering P_{uu} is equal to zero and the cross section of the scattering

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of a polarized beam on a non-polarized target does not contain an azimuthal asymmetry. The number of the necessary independent experiments, in the case of imaginary scattering phases, is equal to the number of the term of the amplitude. The author then investigates the case (1,0), considering only the imaginary phases. The results of this paper lead to the following conclusions: At high energies, where the elastic scattering in a high degree is determined by the non-elastic processes, it is possible to obtain nucleon beams with a considerable value of polarization. The existence of such beams makes it possible to carry out additional experiments. Polarization experiments lead to a sensible method of investigating the spin effects in elastic scattering. There are 15 references, 6 of which are Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (United Institute of Nuclear Research)

SUBMITTED: November 19, 1957

Card 3/4₃

24(5), 16(0)

AUTHORS: Bilen'kiy, S. M., Lapidus, L. I.,
Puzikov, L. D., Ryndin, R. M.

SCV/56-35-4-16/52

TITLE: On the Determination of the Matrix for the "reaction
 $a+a' \rightarrow b+b'$ (Ob opredelenii matritsy reaktsii $a+a' \rightarrow b+b'$)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958,
Vol 35, Nr 4, pp 959 - 961 (USSR)

ABSTRACT: Wolfenstein (Vol'fenshteyn) and Ashkin set up a
general expression for the scattering amplitudes of
particles with spin 0 and 1/2 on particles with spin
1/2 on the basis of the invariance conditions in
space revolutions and reflections and time reversal.
Proceeding from these expressions, and by using the
unity of the S-matrix, Puzikov, Ryndin and Smorodinskiy
(Ref 2, investigated the question as to how many ex-
periments are necessary in order to obtain a complete
determination of the scattering amplitudes in these
cases. The authors of the present paper investigate
the general case of a reaction of the scheme $a+a' \rightarrow b+b'$.

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On the Determination of the Matrix for the Reaction $a+a' \rightarrow b+b'$ SOV/56-35-4-18/52

The number of complex scalar functions defining the reaction matrix M is determined with the aid of the conditions of invariance with respect to space rotations and reflections. Time reversal invariance leads to relations between polarization effects in direct and inverse reactions. An expression for the amplitude of the process and another for the ratio between the matrices of direct and inverse direction is first given. On the basis of an example of 2 channels the number of experiments is determined that is necessary for a complete determination of the reaction matrix. In conclusion the authors thank Ya.A.Smorodinskiy for discussing the problem dealt with. There are 3 references, 2 of which are Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (United Institute for Nuclear Research)

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24(5)

SOV/56-35-6-41/44

AUTHOR:

Lapidus, L. I.

TITLE:

On the Problem of Verifying the Invariance of Interaction in the Inversion of Time (K voprosu o proverke invariantnosti vzaimodeystviya pri obrashchenii vremeni)

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 6, pp 1580-1581 (USSR)

ABSTRACT:

Determination of the non-invariance of weak interactions in spatial inversions and in charge-conjugation considerably increased interest in a detailed investigation of the symmetry properties of strong interaction. The present paper aims at pointing out the possibility of an invariance of different interactions in the case of time invariance. This possibility is based on the connection of polarization phenomena in inverse reactions (Refs 1-5). Recently, a verification of the equality of polarization and asymmetry in the case of elastic scattering was suggested for the investigation of the symmetry of strong interaction for an inversion of time (Refs 7,8,9,10). By using the results of references 1-5 it is possible to carry out an analogous verification also by means of various nuclear reac-

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On the Problem of Verifying the Invariance of Interaction in the Inversion of Time

tions. Thus, the polarization of the neutron in the reaction $d + d \longrightarrow n + \text{He}^3$ (if the deuterons are not polarized) agrees exactly (up to the usual factor) with the asymmetry in the cross section of the inverse reaction $n + \text{He}^3 \longrightarrow d + d$ (if the neutrons are polarized). Verification of the connection between polarization and asymmetry and between complicated relations is also a verification of the invariance of interaction with respect to an inversion of time. Also the reaction $p + \text{T} \rightleftharpoons n + \text{He}^3$ is suited for this purpose. Among the reactions with participation of γ -quanta, the reaction $n + p \rightleftharpoons d + \gamma$ is suited for this purpose. The reaction $p + p \rightleftharpoons d + \pi^+$ is suited for the investigation of the time-reversibility of pion production processes. The reaction $K^- + d \rightleftharpoons \Sigma^- + p$ can be used for the investigation of interaction symmetry under participation of strange particles. Also the investigation of polarization phenomena in the last-mentioned reaction might help to solve the problem as to whether there is a connection between the low degree of asym-

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metry in the decay of the Σ^- -particle (which is produced in the reaction $\pi + N \longrightarrow \Sigma^- + K$) and the threshold value effects. There are 15 references, 8 of which are Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (United Institute for Nuclear Research)

SUBMITTED: September 6, 1958

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24(0)

SOV/89-6-6-6/27

AUTHORS: Lapidus, L. I., Okun', L. B.

TITLE: The Physics of High Energies (Fizika vysokikh energiy). (Survey on the Material of the VIII International Conference on Physics of High Energy) (Obzor materialov VIII Mezhdunarodnoy konferentsii po fizike vysokikh energiy)

PERIODICAL: Atomnaya energiya, 1959, Vol 6, Nr 6, pp 648 - 656 (USSR)

ABSTRACT: The authors give a survey on the subjects which were dealt with on this Conference (Geneva, June 29 - July 5, 1958). At first, the synoptic lectures are mentioned and then the subjects of the lectures (without mentioning the individual lecturers) are divided as follows: detection of new particles, the fundamental particle properties, the interaction between the particles, the weak interaction, the non-conservation of parity, the non-conservation of the charge parity, the conservation of combined parity, the longitudinal neutrino, the "two-component" electron, the vectorial and axially-vectorial interaction variant, the universal weak interaction, the neutron decay, the muon decay, the pion decay, the decay of strange particles, the capture of muons by nucleons, the rule $T = 1/2$, the electro-

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The Physics of High Energies. Survey on the Material SOV/89-6-6-6/27
of the VIII International Conference on Physics of High Energy)

magnetic interaction, the strong interaction, the structure of nucleons, the nucleon-nucleon interaction (communications of a group of collaborators Wang Shu-fen (China), Danish (Poland), Dalkhazhav (Mongolia), Vishki (Roumania), Markov (Bulgaria) on p-p interaction at 9 Bev, investigations on the synchrophasotron of the Ob'yedinennyy institut yadernykh issledovaniy (Joint Institute for Nuclear Researches), moreover, a communication by Blokhintsev et al on diffraction scattering), the antinucleons, the interaction between pions and nucleons, the interaction between π -quanta with nucleons, the production of strange particles and the interaction of strange particles. In conclusion, the theoretical results obtained are briefly dealt with and a criticism of the Heisenberg theory (communication made by Bogolyubov) is made. The 9th International Conference on Physics of High Energies will take place in the Soviet Union in the town of Kiyev in July 1959.

SUBMITTED: February 13, 1959

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24(5)

AUTHOR:

Lapidus, L. I.

SOV/56-36-1-40/62

TITLE:

On the Estimation of the Contribution of Nucleon-Antinucleon Interaction to the Dispersion Relation for the Scattering of Nucleons by Nucleons (Ob otsenke vklada nuklon-antinuklonnogo vzaimodeystviya v dispersionnoye sootnosheniye dlya rasseyaniya nuklonov nuklonami)

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 1, pp 283-290 (USSR)

ABSTRACT:

The investigation of the contribution mentioned in the title would be of great interest in connection with the determination of approximation relations as well as from a general point of view. The author endeavors to estimate this contribution at low energies by means of an already previously described method (Ref 3) which is based upon the theory of the effective radius. First, the amplitude for NN-forward-scattering is written down. The first part of this paper deals with the scattering of neutrons by protons. Calculations are followed step by step. Taking the deuteron state into account is far more essential than the one-meson term, which would be of importance for π N-scattering. The term taking

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Scattering of Nucleons by Nucleons

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the nonelastic process - annihilation - into account, exercises practically no influence; it is not greater than the error committed in calculating the contribution of the deuteron state. Under the conditions assumed here, the latter amounts to $+(5450 \pm 13)$, and the contribution of the one-meson state is -162 . A direct comparison between the dispersion relations and the experimental data on n-p-scattering at low energies shows that the contribution made by nucleon-antinucleon interaction to the scattering of nucleons in this energy range is small. Therefore, the exact dispersion relation can, within this energy range, be replaced by the approximated dispersion relation without any major error being committed. The second part of this paper deals with proton-proton scattering. Variations with respect to the results obtained in the first chapter are mentioned in short. In conclusion, the scattering of nucleons in the state with $T = 0$ is dealt with in short. In this case the p-states play a more important part than in the cases previously investigated. The approximated relations derived

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Nucleon-Antinucleon Interaction to the Dispersion Relation for the
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in the present paper can be of use for the analysis of experimental data on NN-scattering within the range of low energies, especially if more exact data concerning NN-scattering in the p-states will be available. The author thanks V. Z. Blank (deceased) and P. S. Isayev for several useful discussions and Ya. A. Smorodinskiy for advice. There are 14 references, 9 of which are Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (United Institute for Nuclear Research)

SUBMITTED: July 31, 1958

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2: (1.)

AUTHORS:

Lapidus, L. I., Chou Kuang-chao

SOV/56-37-1-41/64

TITLE:

On the Problem of Investigating the Interaction of Pions With Hyperons (K voprosu ob izuchenii vzaimodeystviya π -mezonov s giperonami)

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 1(7), pp 283 - 288 (USSR)

ABSTRACT:

The authors investigated the reactions $\tilde{K}+N \rightarrow \tilde{K}+N$, $\tilde{K}+N \rightarrow \Sigma(\Lambda)+\pi$, $\Sigma(\Lambda)+\pi \rightarrow \Sigma(\Lambda)+\pi$ within the range of such energies of the K-meson where the channels can be neglected in which 2 pions originate. As the elements of the S-matrix for the above-mentioned reactions are connected by the conditions of unitariness, the following problem results: Which data on the amplitudes of the scattering $\Sigma(\Lambda)+\pi \rightarrow \Sigma(\Lambda)+\pi$ can be obtained by investigating the cross sections and polarizations in the processes $\tilde{K}+N \rightarrow \tilde{K}+N$ and $\tilde{K}+N \rightarrow \Sigma(\Lambda)+\pi$? Part I of the present paper tries to solve this problem. The spin of the K-meson is set equal to zero. The interactions are assumed to be invariant with respect to a reflection of space, against a reversal of time, and against a turning in the isotropic space. The

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above reactions are described by the elements of the T-matrix ($iT=S-1$) which are diagonal with respect to the quantum number of the isospin. The spin structure of the scattering amplitude a_α can be represented in the form $a_\alpha = A_\alpha + iB_\alpha(\vec{\sigma}[\vec{n} \vec{n}'])$, the unit vectors \vec{n} and \vec{n}' , respectively, being parallel to the momentum of the particles in the initial (final) state within the center-of-mass system. A_α and B_α denote 2 complex scalar functions of the energy and of $\vec{n} \vec{n}'$. The authors analyze the conditions for a determination of the T-matrix from experimental data. It is then investigated which information can be obtained by only studying the processes $\tilde{K}+N \rightarrow \tilde{K}+N$ and $\tilde{K}+N \rightarrow \Sigma(\Lambda)+\pi$. A table contains 8 reactions of this type as well as their amplitudes. For the π - Σ -scattering, the phase difference in the individual states with the isospin zero is determined by investigating reactions with K-particles. Chew and Low as well as L. B. Okun' and I. Ya. Pomeranchuk, suggested to investigate nonspherical collisions as a method of determining the interaction between

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unstable particles. In the authors' opinion, this method is suitable for determining the amplitude of the scattering $\Sigma(\Lambda)+\pi \rightarrow \Sigma(\Lambda)+\pi$ by use of the processes $\Sigma+N \rightarrow \Sigma(\Lambda)+N+\pi$, $\Lambda+N \rightarrow \Sigma+N+\pi$. The authors then investigate a reaction of the type $\Sigma^+p \rightarrow \Lambda+p+\pi^+$ within the range near the pole $(p_\Sigma - p_\Lambda)^2 = \mu^2$. Within this range, the process $\Sigma^+ \rightarrow \Lambda+\pi^+$, $\pi^+p \rightarrow \pi^+p$ predominates. If in that range where the pole term predominates the vector of polarization of the Λ -particles originating by the reaction $\Sigma^+p \rightarrow \Lambda+p+\pi^+$ could be measured, not only the effect of the non-pole terms could be estimated, but also data on the relative parity of the Λ and Σ -hyperons could be obtained. In some cases, the investigation of the polarization of the products in peripheral collisions may deliver data on the parity of unstable particles. The authors thank M. A. Markov for useful discussions. There are 1 table and 4 references, 2 of which are Soviet.

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SOV/56-37-6-27/55

AUTHORS: Lapidus, L. I., Chzou Guan-chzhao

TITLE: Dispersion Relations for Scattering of γ -Quanta
by Nucleons

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki,
1959, Vol 37, Nr 6, pp 1714-1721 (USSR)

ABSTRACT: Dispersion equations were derived for the scattering
of γ -quanta by nucleons with one subtraction. For
forward scattering, six relations were obtained which
contained no unknown constants or infrared divergences.
The evaluation of the imaginary parts of the amplitude
was done with the aid of unitary S-matrix. At energies
of γ -quanta below the threshold of π -meson pro-
duction, the magnitude of the imaginary parts
 $R_1 \dots R_6$ was small. Above the threshold
 $R_1 \dots R_6$ were determined from the unitary
condition of S-matrix with the omission of terms

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 γ -Quanta by Nucleons

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that are quadratic in respect to the electromagnetic interactions:

$$\begin{aligned} & i[\mathcal{M}^+(-k', -e', -k, -e, -\sigma) - \mathcal{M}(k', e', k, e, \sigma)] = \\ & = \frac{v_c}{2\pi} \int d\Omega(q_+) [T_{\gamma \rightarrow \pi^+}^+(q_+, k', e', \sigma) T_{\gamma \rightarrow \pi^+}(q_+, k, e, \sigma)] + \\ & + \frac{v_c}{2\pi} \int d\Omega(q_0) [T_{\gamma \rightarrow \pi^0}^+(q_0, k', e', \sigma) T_{\gamma \rightarrow \pi^0}(q_0, k, e, \sigma)], \end{aligned} \quad (38)$$

where the amplitude of the photoproduction of pions on protons is:

$$\begin{aligned} T_{\gamma \rightarrow \pi}(q, k, e, \sigma) = & iE_1(\sigma e) - M_1\{(|k|q) - i(\sigma|k|q)\} - \\ - & M_2\{2(|k|q) + i(\sigma|k|q)\} + \frac{i}{2}E_2\{(\sigma k)(eq) + (\sigma e)(kq)\} \end{aligned} \quad (39)$$

The total cross section of γ -quanta interactions was shown to be:

$$\sigma_t = (4\pi/v_c) \operatorname{Im}[R_{1c}(0^0) + R_{2c}(0^0)] = 4\pi[|E_1|^2 + |M_1|^2 + 2|M_2|^2 - |E_2|^2/6], \quad (41)$$

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With the aid of the above equations, it was shown that:

$$\operatorname{Re} \mathcal{S}_1(v) = \frac{1}{0} \frac{2v^3}{\pi} \int_0^\infty \frac{dv'}{v'} \frac{|E_2^+|^2 + |E_2^0|^2}{v'^2 - v^2},$$

$$\operatorname{Re} \mathcal{M}_3(v) = \frac{2}{3} \mu^2 v + \frac{2v^3}{\pi} \int_0^\infty \frac{dv'}{v'} \frac{|M_3^+|^2 + |M_3^0|^2}{v'^2 - v^2},$$

$$\operatorname{Re} [\mathcal{S}_1(v) + 2\mathcal{S}_2(v)] = -\frac{e^2}{M} + \frac{v^3}{2\pi^2} \int_0^\infty \frac{dv' (e^2 + e'^2)}{v'^2 - v^2} - \operatorname{Re} \mathcal{S}_2(v) - 2\operatorname{Re} [\mathcal{M}_3(v) - \mathcal{M}_3^0],$$

$$\operatorname{Re} [\mathcal{S}_1(v) - \mathcal{S}_2(v)] = -\left[2\left(\frac{e}{2M}\right)^2 - \frac{e}{M} \mu \right] v + \frac{2v^3}{\pi} \int_0^\infty \frac{dv'}{v'} \frac{|E_1^+|^2 + |E_1^0|^2}{v'^2 - v^2},$$

$$\operatorname{Re} C(\mathcal{M}_3, \mathcal{S}_2) = \operatorname{Re} C(\mathcal{S}_2, \mathcal{M}_3) = \frac{2v^3}{\pi} \int_0^\infty \frac{dv'}{v'} \frac{(\operatorname{Re} E_2^+ M_3)^2 + (\operatorname{Re} E_2^0 M_3)^2}{v'^2 - v^2}. \quad (42)$$

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The contribution due to the production of several

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π -mesons and other particles was disregarded. There are 14 references, 7 Soviet, 7 U.S. The 5 most recent U.S. references are: M. Gell-Mann, M. L. Goldberger, W. E. Thirring, Phys. Rev., 95, 1612, 1954; A. A. Logunov, A. R. Frenkin, Nucl. Phys., 7, 573, 1958; T. Akiba, J. Sato, Prog. Theor. Phys., 19, 93, 1958; M. Kawaguchi, S. Minami, Progr. Theor. Phys., 12, 789, 1954; F. E. Low, Phys. Rev., 96, 1428, 1954.

ASSOCIATION: Joint Inst. Nuclear Research, USSR (Ob'edinenny
institut yadernykh issledovaniy, SSSR)

SUBMITTED: July 1, 1959

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LAPIDUS, L.I., and CHOU KUANG-CHAO

"Elastic Scattering of γ -Rays by Nuclei"

"Elastic Scattering of Quanta by Deutrons Below the Pion Production Threshold."

"Inelastic Scattering in the Final States and the Threshold Anomalies."

"Isotopic Spin Conservation in Meson Scattering and Production."

papers presented at the International Conference on High Energy Physics, Rochester, N.Y. and/or Berkly California, 25 Aug - 16 Sep 1960.

LAPIDUS, L.I.; CHZHOU GUAN-CHZHAO [Chou Kuang-chao]

Nucleon scattering of γ -quanta near the threshold of meson generation. Zhur. eksp. i teor. fiz. 38 no.1:201-211 Jan '60.
(MIRA 14:9)

1. Ob"edinennyy institut yadernykh issledovaniy.
(Gamma rays--Scattering) (Nucleons)

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B006/B056

24.6900

AUTHORS:

Lapidus, L. I., Chzhou Guan-chzhao

TITLE:

The Dispersion Relations and an Analysis of the Energy
Dependence of the Cross Sections Near the Threshold of
New Reactions

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960,
Vol. 39, No. 1(7), pp.112-119

TEXT: As already shown in a previous paper (Ref. 1), the dispersion relations in the case of (γN) scattering near the pion production threshold lead to jumps of the derivatives of the real part of the amplitude if the energy dependence of the reaction cross section near the threshold is taken into account. (The nonmonotonic course of $\sigma(\omega)$ near the pion production cross section was dealt with phenomenologically in the diploma dissertation of G. Ustinova, and also in Ref. 2). In the present paper the application of the dispersion relations is made for an analysis of the energy dependence of the scattering- (and reaction) amplitudes near the threshold of a new reaction $a+b \rightarrow c+d$. The occurrence of jumps of the

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derivatives of the forward scattering amplitudes leads, within the framework of dispersion relations, to an analysis of the integrals of the form

$(k_0^2/4\pi^2)P \int \frac{d\omega}{k} \frac{\sigma(\omega)}{\omega + \omega_0}$, where $\sigma(\omega)$ is the total cross section, which com-

prises the inelastic (σ_c) and the elastic (σ_g) ones. The application of the dispersion relations makes possible an investigation, both of the "local effects" near the threshold, which, in certain cases, lead to the occurrence of peaks, dips, and steps, and of the general influences exerted by inelastic processes. An investigation of (γN) scattering shows that of the 6 scalar amplitudes describing the transition matrix, only two contain "local effects". The existence of the other highly energy-dependent amplitudes renders analysis more difficult. For a detailed analysis of the influence exerted by the inelastic processes it is necessary to investigate the dispersion relations for momentum transfer

$Q^2 \neq 0$; the authors, however, confine themselves to $Q^2 = 0$ for the scalar

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function $A(\omega) = \text{Sp } M(\omega, q^2=0)$, the trace of the scattering matrix, whose imaginary part is related with the total cross section. The relations obtained are, among other things, used for the purpose of investigating the photoproduction of neutral pions $\gamma + p \rightarrow p + \pi^0$ near the threshold of the reaction $\gamma + p \rightarrow n + \pi^+$. Further, an investigation of the anomalies near threshold is dealt with. General relations are derived which represent the nonmonotonic variation of the forward scattering amplitudes as an energy function. A study of the energy dependence of one of the amplitudes of elastic γd forward scattering shows that, from the formulas obtained, it is possible to estimate the role of the deuteron photodisintegration in deuteron polarizability. It is also shown that a consideration of the influence exerted by inelastic processes and especially by deuteron photodisintegration is of importance in the analysis of γd scattering within a wide energy range. A. I. Baz' is mentioned in the paper. There are 1 figure and 9 references: 4 Soviet and 5 US.

ASSOCIATION: Ob'yedinennyy institut yadernykh issledovaniy
(Joint Institute of Nuclear Research)

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B006/B056

24.6900

AUTHORS: Lapidus, L. I., Chzhon Guan-chzhaoTITLE: Final-state Inelastic Interactions¹⁹ and the Peculiarities
Near the Threshold

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 2(8), pp. 364-372

TEXT: It is well known that anomalies occur near the threshold of certain reactions. The present paper makes a contribution towards investigating them. It is shown that the energy spectrum of particle a from the $A + B \rightarrow a + C + D$ reaction near the threshold of the $C + D \rightarrow E + F$ reaction may take a non-monotonic course. As an example, the authors choose the K-meson spectrum of the $N + N \rightarrow \Lambda + N + K$ reaction in the region of Λ -N pair energies near the threshold of the $\Lambda + N \rightarrow \Sigma + N$ reaction. Shape and nature of the spectral anomalies depend, besides on the cross section of the new inelastic process, also on spin and parity of the particles. An investigation of the anomalies may, if carried out with sufficient accuracy, be of assistance when determining the properties

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Final-state Inelastic Interactions and the
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of the produced particles. The authors assume that the $N + N \rightarrow Y + N + K$ reaction in the final state may be described by singlet and triplet s-waves of the Y-N system. In Part 2 of the paper, the authors describe a phenomenological analysis of the kinematics of the reactions, and investigate especially the process $p + p \rightarrow \Lambda + p + K$ below the $p + p \rightarrow \Sigma^0 + p + K^+$ reaction threshold. Formulas are derived for the energy spectrum of the K-mesons and the polarization of the Λ -particles and nucleons (in the case of a polarized incident nucleon beam). In Part 3, the inelastic interaction in the final state is investigated. Proceeding from the unitarity of the S-matrix and the analyticity of the reaction amplitudes, the authors give a general formulation of the theory of inelastic interaction in the final state. In Part 4, local anomalies are investigated for the K-meson spectrum of the $N + N \rightarrow \Lambda + N + K$ reaction in the Σ -hyperon production threshold. In Part 5, the results obtained are discussed. In order to prove the anomalies, i.e., the non-monotonic course of the energy spectrum of particle a experimentally, good energy resolution is necessary in addition to high degree of accuracy. Finally, the non-monotonic particle energy curves of a number of other processes are discussed. In the appendix, the authors give a theoretical analysis of Y-K pair

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Final-state Inelastic Interactions and the
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production in np collisions, and discuss the scalar K-meson production
in NN collisions. V. N. Gribov (Ref. 8) is mentioned. There are
10 references: 4 Soviet and 6 US. 4

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy
: (Joint Institute of Nuclear Research)

SUBMITTED: February 23, 1960

Card 3/3

84412

S/056/60/039/004/030/048
B006/B063

24.6520

AUTHORS:

Lapidus, L. I., Chzhou Guan-chzhao

TITLE:

Elastic Scattering of Gamma Quanta by Nuclei

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960,
Vol. 39, No. 4(10), pp. 1056 - 1058

TEXT: In a previous paper the authors studied the scattering of gamma quanta by deuterons below the pion production threshold using dispersion relations. They now describe a theoretical study of the scattering of low-energy gamma quanta by nuclei. Dispersion relations have already been used in Refs. 2 and 3 to analyze the elastic scattering of gamma quanta by nuclei, but only for energies above the (γ, N) threshold. The well-known non-monotonies near the (γ, n) threshold appear when the production of particles in the S-state is taken into account. Dispersion relations not only allow the Wigner-Baz' effect to be treated but also the effect of inelastic processes on the energy dependence of the elastic scattering amplitudes to be considered. The authors believe that within the framework of dispersion relations, the first maximum of the gamma-quantum scattering

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Elastic Scattering of Gamma Quanta by Nuclei

S/056/60/039/004/030/048
B006/B063

cross sections is related to dispersion effects near the threshold. The theoretical study is restricted to forward scattering in dipole approximation, which is in good agreement with experimental results up to about 30 Mev. Proceeding from the formulas for the scattering amplitudes for spin-0 and spin-1/2 nuclei, the authors study the energy dependence of the elastic scattering cross sections near the photonuclear reaction threshold. The energy dependence of the scattering amplitudes was calculated from the dispersion relations (3) and experimental data from Ref. 6. The results obtained are illustrated in Fig. 1. After considering a number of experimental data, an energy dependence of the scattering cross section is obtained which is illustrated by Fig. 2, and is in qualitative agreement with the experimental results. For the scattering cross section of aluminum (for which the experimental data are taken from Ref. 6) near the first maximum, one obtains a value of about $2 \cdot 10^{-28} \text{ cm}^2$, which is close to the experimental value. As giant resonance makes also a contribution to this process, the half-width attains more than 2 Mev. Finally, the authors discuss the possibility of calculating the polarizability α of the nucleus from an absorption cross section which is known for a wide energy range.

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Elastic Scattering of Gamma Quanta by Nuclei S/056/60/039/004/030/048
B006/B063

A formula for α is given. Numerically, one obtains $\sim 2 \cdot 10^{-39} \text{ cm}^3$ for Al
and $\alpha = (0.70 \pm 0.05) \cdot 10^{-40} \text{ cm}^3$ for He_2^4 . The authors thank

Ya. A. Smorodinskiy for discussions. There are 2 figures and 7 references:
3 Soviet and 4 US.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint
Institute of Nuclear Research)

SUBMITTED: May 12, 1960



Card 3/3

86901

S/056/60/039/005/018/051
B006/B077

24.6900
AUTHORS:

Lapidus, L. I., Chzhou Guan-chzhao

TITLE:

Elastic Scattering of γ -Quanta by Deuterons Below the Pion Production Threshold

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960,
Vol. 39, No. 5(11), pp. 1286-1295

TEXT: This paper presents an analysis of the elastic scattering of gamma quanta below the pion production threshold by employing the dispersion relations and the unitarity conditions of the S-matrix. The scattering of the gamma-quanta by deuterons belongs to those processes whose amplitude is mainly influenced by inelastic processes like the photodisintegration of the deuteron or the photoproduction of mesons. So far the effect of the pion photoproduction has not been examined, while that of the deuteron photodisintegration has been dealt with in Ref. 1. The authors limit their analysis of the γd -scattering to the forward scattering only. The calculation of the dispersion integral is done by considering the electrical dipole and magnetic dipole photodisintegration cross sections.

Card 1/3

86901

Elastic Scattering of γ -Quanta by Deuterons
Below the Pion Production Threshold

S/056/60/039/005/018/051
B006/B077

A phenomenological phase shift analysis is first made and the imaginary parts of the scattering amplitudes are expressed through terms which characterize the deuteron photodisintegration. The dispersion relations of forward scattering and the theorem of small energies are then studied; the scattering of γ -quanta by nuclei with an arbitrary spin is considered in the low energy limit. The elastic γ d-scattering cross section is derived phenomenologically as an energy function based on data of the deuteron photodisintegration. The dispersion integrals are estimated for the range $E_\gamma \leq 100$ Mev. The real and imaginary parts of the amplitudes are obtained and problems concerning the polarizability of the deuteron and the nucleons are discussed. It is noted that these results deviate greatly in a wide energy range from those obtained by a momentum approximation. In the energy range under consideration it is not necessary to allow for the pion photoproduction. The results obtained for forward scattering are also valid for other scattering angles in dipole approximation. A.M. Baldin, V. I. Gol'danskiy, and Ya. A. Smorodinskiy are thanked for discussions. L. Landau, Ye. Lifshits, and A. B. Migdal are mentioned. There are 2 figures and 13 references: 8 Soviet, 1 Dutch, and 4 US.

Card 2/3

LAPIDUS, L. I., Dr. Phys-Math. Sci (diss) "Questions of Theory of Strong Interactions," Dubna, 1961, 19 pp. (Combined Institute of Nuclear Research, Laboratory of Nuclear Problems), 160 copies (KL Supp, 12-61, 248).

LAPIDUS, L.I.; CHOU KUANG-CHAO

On $\bar{K} + N \rightarrow \Lambda(\Sigma) + \gamma$ processes. Dubna, Izdatel'skii otdel Ob"edinennogo in-ta iadernykh issledovani, 1961. 11 p.
(No subject heading)

LAPIDUS, L.I.; CHOU KUANG-CHAO

On photon-nucleon scattering. Dubna, Ob"edinenyyi in-t iadernnykh
issledovaniy, 1961. 28 p.

(MIRA 14:11)

(No subject heading)

LAPIDUS, L.I.; CHZHOU GUAN-CHZHAO [Chou Kuang-chao]

Role of the single-meson pole diagram in the scattering of gamma-quanta by protons. Zhur.eksp.i teor.fiz. 41 no.1:294-302 J1 '61.
(MIRA 14:7)

1. Ob"yedinennyy institut yadernykh issledovaniy.
(Mesons) (Protons) (Gamma rays--Scattering)

LAPIDUS, L.I.; CHZHOU GUAN-CHZHAO [Chou Kuang-chao]

$\bar{K} - N \rightarrow \Lambda(\Sigma) + \gamma$ processes. Zhur. eksp. i teor. fiz. 41
no.4:1310-1314 0 '61. (MIRA 14:10)

1. Ob"yedinennyy institut yadernykh issledovaniy.
(Nuclear reactions)

LAPIDUS, L.I.; CHZHOU GUAN-CHZHAO [Chou Kuang-chao]

Scattering of γ -quanta by nucleons. Zhur. eksp. i teor. fiz.
41 no.5:1546-1555 N '61. (MIRA 14:12)

1. Ob'yedinennyy institut yadernykh issledovaniy.
(Gamma rays—Scattering)
(Nucleons)

LAPIDUS, L.I.; SARANTSEVA, V.R., tekhn. red.

[Scattering of γ -quanta and the polarizability of nuclei and nucleons] Rasseianie γ -kvantov i poliarizuemost' iader i nuklonov. Dubna, Ob"edinennyi in-t iadernykh issl., 1962. 6 p.
(MIRA 15:6)

(Gamma rays—Scattering)
(Nuclei, Atomic) (Nucleons)

LAPIDUS, L.I.; SARANTSEVA, V.R., tekhn. red.

[Threshold singularities in pion-nucleon exchange scattering]
Okoloporogovye osobennosti v obmennom pion-nuklonnom rasseianii.

Dubna, Ob"edinennyi in-t iadernykh issl., 1962. 8 p.

(MIRA 15:6)

(Scattering (Physics)) (Mesons) (Nucleons)

LAPIDUS, L. I.

~~SECRET~~
"Threshold Anomalies in Exchange Pion-Nucleon Scattering"

report presented at the Intl. Conference on High Energy Physics, Geneva,
4-11 July 1962

Joint Inst. for Nuclear Research
Laboratory of Nuclear Problems

LAPIDUS, L. I.

"Gamma-Ray Scattering by Protons and Polarizability of Nucleons"

report presented at the 11th Intl. Conference on High Energy Physics,
Geneva, 4-11 July 1962

Joint Institute for Nuclear Research, Laboratory of Nuclear Problems

S/056/62/043/003/047/063
B108/B102

AUTHOR: Lapidus, L. I.

TITLE: Threshold singularities in pion-nucleon exchange scattering

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43,
no. 3(9), 1962, 1053 - 1056

TEXT: Pion-nucleon exchange scattering $\pi^- + p \rightarrow \pi^0 + n$ was studied in order to establish possible discontinuities in the energy dependence of the differential cross section of this process. The shape, energy width, and height of the discontinuities were investigated by the method of the dispersion relations [ZhETF, 38, 201, 1960; 39, 112, 1286, 1056, 1960]. The forward scattering cross section, the real part of the scattering amplitude T_0 , and its square magnitude are shown in Fig. 1 as functions of pion energy. Energy-dependent deviations from the scattering amplitude are regarded as perturbations $\delta\sigma$ not exceeding 1 mb with an energy width of $\Delta = 5$ Mev. Energy discontinuities in σ are very sensitive to discontinuities in the total π^+ and π^- interaction cross sections.

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Threshold singularities in...

S/056/62/043/003/047/G63
B108/B102

Perturbations of the type $\delta\sigma(\omega) = ak\sqrt{\omega - \omega_t}$ cause discontinuities in the real part of the scattering amplitude which amount at threshold energy ω_t to about four times those caused by perturbations of the type $\delta\sigma(\omega) = bk(\omega - \omega_t)^2$. There are 3 figures.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: April 11, 1962

Card, 2/2

24.6200

h1131

S/056/62/043/004/031/061
B106/B102

AUTHOR: Lapidus, L. I.

TITLE: Scattering of gamma quanta and polarizability of nuclei and nucleons

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 4(10), 1962, 1358-1361

TEXT: The magnetic polarizability of nuclei, determined with the aid of the dispersion relations for the gamma scattering amplitudes, is found to be considerably smaller than the electrical polarizability. This is due to the role played by the magnetic transitions during photonuclear processes, which, however, is less significant in heavy nuclei. Considering the quadratic frequency term in the expansion of the real part of the amplitude R_2 , and considering the dispersion relations for R_1+R_2 as well as for R_1-R_2 , one obtains for the polarizabilities of the proton

$$\alpha_m = \frac{2}{\pi} \int_0^{\infty} \frac{d\omega}{\omega^2} (|M_1|^2 + 2|M_3|^2 + \frac{1}{3}|M_2|^2 - \frac{1}{6}|E_2|^2) \text{ and}$$

Card 1/2

Scattering of gamma quanta and...

S/056/62/043/004/031/061
B108/B102

$$\alpha_e = \frac{2}{\pi} \int_{\nu_t}^{\infty} \frac{d\nu}{\nu^2} (|E_1|^2 + 2|E_3|^2 + \frac{1}{3}|E_2|^2 - \frac{1}{6}|K_2|^2).$$

The amplitudes of magnetic (electrical) absorption in the expressions for the electrical (magnetic) polarizabilities are not large and leave the whole term positive. Taking account of pion photoproduction only in the resonance p-state, one obtains $\alpha_m \approx 2 \cdot 10^{-43} \text{ cm}^3$ and $\alpha_e \approx 9 \cdot 10^{-43} \text{ cm}^3$. These values are consistent with experimental data. ✓

ASSOCIATION: Ob'yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: April 11, 1962

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LAPIDUS, L.I.

Interpretation of an experiment involving high-energy
neutrinos. Zhur. eksp. i teor. fiz. 44 no.2:755-758 F '63.
(MIRA 16:7)

1. Ob'yedinennyy institut yadernykh issledovaniy.

S/056/63/044/004/031/044
B102/B186

AUTHOR: Lapidus, L. I.

TITLE: Effect of inelastic processes on electron-positron and electron-electron scattering

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 44, no. 4, 1963, 1333 - 1336

TEXT: The effects exerted by some inelastic processes usually not covered by the electrodynamics of electrons and quanta on the real part of elastic ee-scattering amplitudes are considered. Since there are no empirical data, these effects are estimated in single-photon approximation. With the help of the dispersion relations the following results are obtained: For

$$e^+ + e^- \rightarrow \mu^+ + \mu^- : \quad \delta D_+(\omega_0) = \frac{1}{6\pi} \left(\frac{e^2}{\hbar c} \right)^2 \frac{k_{e\mu} k_{e\mu} \hbar c}{\omega_0 \omega_i m c^2} \frac{\Lambda_+(y_0)}{y_0} \quad (4)$$

$$\Lambda_+ = y_0 \left\{ \frac{28}{15} + (y_0 - 1) \left(\frac{8}{3} + y_0 \right) - y_0 (2 + y_0) (y_0 - 1)^{1/2} \arctg (y_0 - 1)^{1/2} \right\} \quad (4')$$

np $y_0 \geq 1$,

$$\Lambda_+ = y_0 \left\{ \frac{28}{15} - (1 - y_0) \left(\frac{8}{3} + y_0 \right) + y_0 (2 + y_0) (1 - y_0)^{1/2} \ln \left| \frac{1 + \sqrt{1 - y_0}}{1 - \sqrt{1 - y_0}} \right| \right\}$$

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Effect of inelastic processes on...

S/056/63/044/004/031/044
B102/B186

where $y_0 = \omega_t/\omega_0$, $\omega_t = 2m_\mu^2/m$. For $e^+ + e^- \rightarrow \pi^0 + \gamma$:

$$\delta D_{\pm}(\omega_0) = \frac{k_0^2}{4\pi^2} \left| \frac{a(-K^2)}{a(0)} \right|^2 \frac{2.75 \cdot 10^{-24}}{\omega_0} y_0 \cdot 2\Lambda_{\pm}(\omega_0), \quad (14)$$

where the subscript + refers to e^-e^+ and - to e^-e^- scattering. For e^+e^-

$$\Lambda_{+} = \frac{1}{3} - (y_0 - 1) + (y_0 - 1)^{1/2} \arctg(y_0 - 1)^{1/2}, \text{ при } y_0 \geq 1, \\ \Lambda_{+} = \frac{1}{3} + (-y_0 + 1) - \frac{(1 - y_0)^{1/2}}{2} \ln \left| \frac{1 + \sqrt{1 - y_0}}{1 - \sqrt{1 - y_0}} \right|, \text{ при } y_0 \leq 1 \quad (14'),$$

and for e^-e^- :

$$\Lambda_{-} = \frac{(1 + y_0)^{1/2}}{2} \ln \left| \frac{1 + \sqrt{1 + y_0}}{\sqrt{1 + y_0} - 1} \right| - \frac{1}{3} - (y_0 + 1). \quad (15).$$

For $e^- + e^+ \rightarrow \pi^- + \pi^+$ one obtains

$$\delta D_{\pm}(\omega_0) = \frac{k_0^2}{4\pi^2} \frac{5 \cdot 10^{-20}}{\omega_0} \Lambda_{\pm}(y_0), \quad (18),$$

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Effect of inelastic processes on...

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for e^+e^-

$$\Lambda_+ = 2y_0 \left\{ y_0 \left[\frac{1}{3} - (y_0 - 1) + (y_0 - 1)^{1/2} \arctg (y_0 - 1)^{1/2} \right] - \frac{1}{5} \right\} \text{ при } y_0 \geq 1, \quad (19)$$

$$\Lambda_+ = 2y_0 \left\{ y_0 \left[\frac{1}{3} + (1 - y_0) - \frac{(1 - y_0)^{1/2}}{2} \ln \left| \frac{1 + (1 - y_0)^{1/2}}{1 - (1 - y_0)^{1/2}} \right| \right] - \frac{1}{5} \right\} \text{ при } y_0 \leq 1,$$

and for e^-e^-

$$\Lambda_- = 2y_0 \left\{ y_0 \left[\frac{1}{3} + (1 + y_0) - \frac{(1 + y_0)^{1/2}}{2} \ln \left| \frac{1 + (1 + y_0)^{1/2}}{(1 + y_0)^{1/2} - 1} \right| \right] - \frac{1}{5} \right\} \quad (20).$$

Obviously the effect of inelastic processes, including the production of strongly interacting particles, is small and does not significantly affect the analysis of colliding beam experiments made in an attempt to verify the validity of electrodynamics.

ASSOCIATION: Ob'yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: November 16, 1962

Card 3/3

LAPIDUS, L.I., doktor fiziko-matemat.nauk

Physics of weak interactions and the neutrinos. Priroda 52
no.6:5-8 '63. (MIRA 16:6)

1. Ob'yedinennyy institut yadernykh issledovaniy, Dubna.
(Pontecorvo, Bruno, 1913-) (Neutrinos)

L 64652-65 EWT(m)/T/EWA(m)-2

ACCESSION NR: AT5009468

Z/0000/64/000/000/0232/0236

AUTHOR: Lapidus, L. I. 44, 55

TITLE: New possibilities for investigating nucleon, pion, and Gamma-quanta re-
actions on polarized hydrogen targets 38 29 81

SOURCE: Conference on Low Temperature Physics and Techniques. 3d, 44, 55 Prague, 1963.
Physics and techniques of low temperatures; proceedings of the conference. Prague,
Publ. House of the Czechosl. Academy of Sciences, 1964, 232-236

TOPIC TAGS: hydrogen atom reaction, particle accelerator target, pion scattering,
nuclear scattering, proton scattering, electron scattering

ABSTRACT: The author reviews briefly the new possibilities that the use of
polarized-hydrogen targets uncovers for experimentation with elementary particles,
especially at high energies. An important role in the theory and investigation of
polarization effects in scattering processes and nuclear reactions is played by
rigorous equations that extend the well known detailed-balance relations to include
interactions with a significant spin dependence. The author therefore shows by
means of a simple example how knowledge of the sign of the polarization makes it
possible to determine the parity of strange particles on the basis of exact sym-
metry relations only. In particular, at the high energies made possible by modern 19, 44, 55

Card 1/2

L 64652-65

ACCESSION NR: AT5009468

9

accelerators, in which the hyperon polarization is quite large, polarized targets become useful for quantitative investigations of strong interactions of nucleons, pions, K mesons and γ quanta, since they make possible relatively simple experimental techniques. Schemes are outlined for experiments on pion-nucleon scattering, nucleon-nucleon scattering, scattering of γ quanta by protons (and nuclei), and scattering of high-energy electrons by protons. It is concluded on the basis of the already obtained results that the use of polarized hydrogen targets can serve as a powerful research tool for modern laboratories, because it provides data hitherto obtainable only through very complicated experiments. "Practically the whole of the report is the result of discussions with S. M. Bieln'kiy and R. M. Ryndin, to whom I am deeply indebted." Orig. art. has: 6 formulas. ^{44,55} ^{44,55}

ASSOCIATION: Ob'yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research) ^{44,55}

SUBMITTED: 00

ENCL: 00

SUB CODE: NP

NR REF SOV: 000

OTHER: 000

dm
Card 2/2

L 15155-66 ENT(m)/T

ACC NR: AP6000227

SOURCE CODE: UR/0056/65/049/005/1653/1663

AUTHORS: Bilen'kiy, S. M.; Lapidus, L. I.; Ryndin, R. M.

ORG: Joint Institute of Nuclear Research (Ob'yedinenny institut yadernykh issledovaniy)

TITLE: Double NN scattering with a polarized beam and a polarized target

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 5, 1965, 1653-1663

TOPIC TAGS: nuclear scattering, scattering matrix, scattering cross section, light polarization, particle beam

ABSTRACT: The article discusses possible experiments involving the measurement of nucleon polarization arising as a result of scattering of a polarized beam by a polarized target. Measurement of such complicated polarization characteristics should help eliminate the ambiguities still remaining in phase-shift analysis and make it possible to determine for the first time the components of the third-rank polarization tensor. The structure of this tensor is analyzed and

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L 15155-66

ACG NR: AP6000227

expressions are presented for its components and for the differential cross section for the scattering of an unpolarized beam by an unpolarized target. The polarization correlation is considered for the case of scattering of a polarized beam by an unpolarized target, or an unpolarized beam by a polarized target. The relations between the measured and calculated quantities are derived, and the question of reconstruction of the scattering matrix discussed. Authors are grateful to F. Legar and Z. Yanout for calculating the plots in the figure, and to Yu. M. Kazarinov and Ya. A. Smorodinskiy for useful discussions of the questions considered in the article. Orig. art. has: 1 figure and 55 formulas.

SUB CODE: 20/ SUBM DATE: 28Jun65/ ORIG REF: 006/ OTH REF: 011

Card

2/2 vmb

16169-65 EWT(m)/T/EWA(m)-2 ESD(t)/ESD(gb)/SSD/AFWL/ASD(a)-5/AFETR

ACCESSION NR: AP5000369

S/0053/64/084/002/0243/0301

AUTHOR: Bilen'kiy, S. M.; Lapidus, L. I.; Ry*ndin, R. M.

TITLE: Polarized proton target in experiments with high energy particles

SOURCE: Uspekhi fizicheskikh nauk, v. 84, no. 2, 1984, 243-301

TOPIC TAGS: polarization, strong interaction, particle scattering, proton polarization, proton scattering, nucleon scattering, meson scattering, photoproduction, pi meson, k meson

ABSTRACT: The authors review the possible applications of polarized proton targets in high-energy physics. The possible additional data that can be extracted from such experiments are described, with emphasis on the possibility of reconstituting the elements of the scattering matrices of various elementary particle scattering processes. The analysis is based only on the general requirements of invariance under space rotation or reflection and under time reversal. The main theorems used in the study of polarization phenomena in strong interaction are deduced on the basis of these invariance requirements. The

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L 16169-65

ACCESSION NR: AP5000369

section headings are: 1. Introduction. 2. The "polarization-asymmetry" relation in the case of polarization perpendicular to the reaction plane. The Bohr rule. 3. Symmetry principles and limitations on the form of the reaction amplitude. 4. Spin density matrix. 5. "Polarization-asymmetry" ratio in the case of arbitrary polarization directions. 6. Possible methods of determining the parities of strange particles in experiments with polarized targets. 7. Nucleon-nucleon scattering. 8. Meson-nucleon scattering. 9. Pion and kaon photoproduction. 10. Scattering of gamma quanta and electrons by nucleons. Orig. art. has: 4 figures, 265 formulas, and 2 tables.

ASSOCIATION: None

SUBMITTED: 00

ENCL: 00

SUB CODE: NP

NR REF SOV: 028

OTHER: 057

Card: 2/2

ACC NR: AP7011379

SOURCE CODE: UR/0367/66/004/005/1063/1066

AUTHOR: Bilen'kiy, S. M. -- Bilenky, S. M.; Lapidus, I. I.; Ryndin, R. M.;
Shekhter, L. Sh.

ORG: Joint Institute for Nuclear Research (Ob'yedinennyy institut yadernykh
issledovaniy)

TITLE: Isospin conservation and polarization effects

SOURCE: Yadernaya fizika, v. 4, no. 3, 1966, 1063-1066

TOPIC TAGS: electron spin, strong nuclear interaction, particle
interaction

SUB CODE: 20

ABSTRACT: The reactions $a + a' \rightarrow b + b'$ are treated, where the particles
a and a' (or b and b') belong to the same isotopic multiplet, and the total
isotopic spin of the final (or initial) particles may take only one value.
Relationships have been obtained between polarization characteristics of such
reactions at the angles θ and $\pi - \theta$ (θ is the c.m.s. angle). These rela-
tionships are based only on isotopic invariance and invariance under rota-
tions and reflections. Their experimental verification would be a detailed
test of the isotopic invariance of strong interactions.

Card 1/2

0932 1273

ACC NR: AP7011379

Two of the authors (Bilen'kiy and Lapidus) thank G. M. Osetinskiy for useful discussion of the questions considered here. Orig. art. has: 24 formulas. Based on authors' Eng. Abst. JPRS: 40,393

Card 2/2

LAPIDUS, L.S. (Dnepropetrovsk)

Similitude conditions in model testing taking into account the
creep of materials. Stroil. mekh. i rasch. soor..2 no.6:28-29 '60.
(MIRA 13:12)

(Models and modelmaking)

(Creep of materials)

BEREZANTSEV, Vsevolod Glebovich, doktor tekhn. nauk, prof.; KSENOFONTOV, Aleksandr Ivanovich, kand. tekhn. nauk, dots.; PLATONOV, Yevgeniy Vladimirovich, prof.; SIDOROV, Nikolay Nikolayevich, kand. tekhn. nauk, dots.; YAROSHENKO, Vsevolod Aleksandrovich, kand. tekhn. nauk, dots.; GOL'DSHTEYN, M.N., doktor tekhn. nauk, prof., retsenzent; TERLETSKIY, V.P., inzh., retsenzent; LAPIDUS, L.S., inzh., retsenzent; ZHEREBTSOV, I.V., inzh., retsenzent; GLOTOV, N.M., inzh., retsenzent; SILIN, K.S., inzh., retsenzent; SURODEYEV, V.P., inzh., red.; KHITROV, P.A., tekhn. red.

[Soil mechanics and foundation engineering] Mekhanika gruntov, osnovaniia i fundamenty. Moskva, Vses. izdatel'sko-poligr. ob"edinenie M-va putei soobshcheniia, 1961. 339 p. (MIRA 14:8)

(Soil mechanics)

(Foundations)

LAPIDUS, L.S. (Dnepropetrovsk)

Calculating the heaving of the earth's surface caused by underground
workings. Osn., fund. i mekh. grun. 3 no.1:20-22 '61. (MIRA 14:3)
(Soil mechanics) (Underground construction)

LAPIDUS, L. S.; SHADUNTS, K. Sh.

Using piles for protecting the slopes of loose rock fills.
Vop geotekh no. 5:48-55 '62. (MIRA 17:5)

GOL'DSHTEYN, M. N.; TUROVSKAYA, A. Ya.; LAPIDUS, L. S.

Investigation of mudflows. Vop geotekh no. 5:3-23 '62.
(MIRA 17:5)

GOL'DSHTEYN, M.N., prof.; ZHEREBTSOV, I.V.; TOL'SKAYA, S.Ye.; FRISHMAN, M.A.;
LEVANKOV, I.S.; ROZENBERG, A.M.; BELASHOV, D.A.; TSEKOVNITSKAYA, A.I.;
LAPIDUS, L.S.; YAKOVLEV, B.V.; GUBENKO, Ye.N.; VICHEREVIN, A.Ye., red.

[Preventing the deformation of tracks and structures overlaying
mine workings.] Preduprezhdenie deformatsii puti i sooruzhenii nad
shakhtnymi podrabotkami. Moskva. Transport, 1964. 65p. (Voprosy
geotekhniki, no.8) (MIRA 18:2)

LAPIDUS, L.S., inzh.

Calculating the shifting of the earth's surface caused by
underground workings. Vop. geotekh. no.4:11-27 '61. (MIRA 18:7)

L 32585-66 EWT(1) SCTB DD

ACC NR: AR5024090

SOURCE CODE: UR/0299/65/000/016/G004/G004

AUTHOR: Lapidus, L. Ya.; Dorokhov, L. M.

TITLE: Effect of nitrogen and phosphorus on the photosynthetic
potential in plants with a varied water supply

SOURCE: Ref. zh. Biologiya, Abs. 16Q20

REF SOURCE: Tr. 1-y Resp. nauchn. konferentsii fiziologov i bio-
khimikov rast. Moldavii. Kishinev, Kartya Moldovenyaske, 1964, 196-203

TOPIC TAGS: agriculture science, chlorophyll, photosynthesis, plant
physiology

ABSTRACT: A study was made of the development of the assimilating surface (A), the chlorophyll content (Ch), the daily rate of photosynthesis (Ph) and breathing (B) and the water content in the leaves of summer barley grown in sandy cultures on Helriegel mixtures with varied additions of N and P in doses from 0.1 to 3 under normal or insufficient water supply. An increase in N and P dosages decreased the negative effect of a water-supply shortage on the development of A. At the same time, N induced a decrease, and P an increase in Ch content, especially in the dehydration of the leaves. With a considerable dehydration of the leaves, P eliminated the Ph and D

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depression, thus indicating its protective role during a drought
period. Kishinev Agricultural Institute, S. Tabentskiy

SUB CODE: 06/ SUBM DATE: none

LS
Card 2/2

LAPIDUS, M.

KOTOVA, M.; LAPIDUS, M., starshiy inspektor kontory.

Reduce the number of organizations for geological exploration.
Fin.SSSR 18 no.2:59-61 F '57. (MLRA 10:5)

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